URTICARIA-LIKE REACTION AFTER X-RAY TREATMENT*

G. WEBER, M.D.

For a further evaluation of the mechanism of urticaria-like reactions due to physical influence, we would like to demonstrate the following case:

CASE REPORT

A 69 year old white male patient noted the appearance of numerous small, slightly elevated skin growths since 1941, which were clinically and histologically basal cell epitheliomas. X-ray treatment, started in 1949–50 had to be discontinued because of "intolerance". In 1955 the patient visited our clinic for the first time.

Urticaria-like reactions are rare after X-ray treatment, therefore we investigated the possible etiology. There is the possibility that this mechanism is analogous to urticaria solare.

METHODS

Before we started the investigation of the pathomechanism of the X-ray caused intolerance reaction, it was necessary to determine the threshold of tolerance to roentgen rays. There were two ways:

TABLE 1

X-ray treatment to the unchanged skin of an epithelioma patient

	After:			
	6 hrs.	24 hrs.	48 hrs.	72 hrs.
	A. 1 cm tube ϕ, each 500 r and			
20 kV	E (+), −	E > 1 cm ϕ, U +	E +, U +	E (+), U (+)
30 kV	E +, U(+)	E > 1 cm ϕ, U +(+)	E +, U +(+)	E (+), U +
55 kV	E +, U +	E > 1 cm ϕ, U +	E +, U ++	E (+), U +
70 kV	E ++, −	E > 1 cm ϕ, U ++	E ++, U ++	E (+), U +
100 kV	E ++, −	E > 1 cm ϕ, U +++	E ++, U +++	E (+), U ++
	B. 1 cm tube ϕ, each 55 kV and			
50 r	E (+)	E +, −	E (+), −	−, −
100 r	E +	E ++ > 1 cm ϕ, U(+)	E +, U (+)	E (+), U (+)
200 r	E +(+)	E ++ > 1 cm ϕ, U +	E +, U +	E (+), U (+)
300 r	E ++	E ++ > 1 cm ϕ, U ++	E +, U +	E (+), U +
400 r	E ++	E ++ > 1 cm ϕ, U ++	E +, U ++	E (+), U +

E = erythema.
U = inflamed urticaria-like efflorescences.

X-ray treatment was again given to several epitheliomas of the face and trunk, consisting of 500 r, 4 cm FSD, without filter with 50 kV and 2 mA. After 6 hours he developed erythema and urticaria-like efflorescences in the treated areas, the diameter of which were the same as the used X-ray field. In the areas where the distance of the treated plaques were very close, we observed a diffuse, urticaria-like swelling, which we could explain by the overlapping of the roentgen rays.

A. The application of constant quantities of rays (500 r) with varying kV (20-100), which determine the length of the rays.

B. The application of constant kV (55) with increasing r (50-400).

RETULTS

A. After 6 hours the patient developed erythema in the treated areas which were more intensive with increasing voltage. At 30–55 kV there were distinguished urticaria-like efflorescences. These became palpable after 6 hours. After 24 hours the erythema occupied a diameter of more

*From the Clinic of Dermatology, (Director: Prof. Dr. med. E. Keining, University of Mainz —Germany—Langenbeckstr. 1.

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than 1 cm, which was greater than the diameter of the X-ray field. In all treated areas the urticaria-like efflorescences corresponded to the size of the X-ray field. The lesions showed more thickness with increased voltage. The eruption almost disappeared after 72 hours.

B. Here too, at a constant voltage of 55 kV the development of erythema after 6 hours, and the appearance of urticaria-like efflorescences after 24 hours were noted. They revealed the same depth and almost disappeared after 72 hours. However, the radiation with 50 r (at 55 kV) led to only one erythematous lesion and not to an urticaria-like eruption.

Because of these results it was almost certain that the urticaria-causing effect of the roentgen rays is more dependent upon the whole dosage than upon the voltage-induced wave length.

The question of the mechanism of the described event was next and we thought of an antigen-antibody reaction because of the urticaria like type of the efflorescences. The experiment of Prausnitz-Kuestner was negative, therefore a modification according to Urbach-Koenigstein was tried. This experiment consists of the intracutaneous injection of the serum of a cantharides blister of the allergic patient into a healthy control person with a following exposure to the allergen after 24 hrs.

Accordingly, serum of a blister of the basalioma patient was transferred to a control patient and 24 hrs later the spot of injection was treated with 500 r at 4 cm FSD without filter, 55 kV and 2mA. As a result an inflamed urticaria-like eruption developed after 4 hrs on the same spot and disappeared within the following 24 hrs.

If we treated in the same manner with X-rays the blister fluid of the basalioma patient in a quartz tube before transfering to a control person, we could see the same skin reaction. The efflorescences are only urticaria-like and not urticarial, because the histological and morphological aspect is in strong relation to urticaria. The urticaria-like reaction after X-ray treatment is in distinction from urticaria only by the length of permanency. The use of a sulfhydryl-containing compound (5% cysteine) as protection from X-rays, or antihistamines (Avil) did not stop both reactions either *in vivo* or *in vitro*.

Similiar experiments with blister serum of control persons gave negative results.

DISCUSSION

The intolerance reactions of the skin caused by electromagnetic waves have been the subject of numerous publications (Epstein (1), Abrahamson (2), Gay-Prieto & c. (3), Rajka (4), Sulzberger & Baer (5), Burckhardt (6), Anderson (7), Porter (8) and Wiskemann (9)).

Foremost was the question of the pathogenesis, the prophylaxis and the therapy of the urticaria-like eruptions which are frequently observed after the exposure to natural sunlight (urticaria solaris). However, the analogous findings demonstrate—as it is shown by our case report and in other places (Weber & Braun-Falco (10))—that the human skin can be sensitized not only by the exposure to the visible light but also to considerably shorter electromagnetic waves (roentgen rays).

Furthermore the findings demonstrate that an antigen-antibody reaction is responsible for the development of the urticaria-like intolerance after roentgen radiation; the presence of the reaction was proven by the passive transfer of the antibodies (experiment after Koenigstein-Urbach). The roentgen waves do not have the characteristics of an antigen, it seems to us that they only liberate the antigens. The release of the mechanism by the radiation of the serum *in vitro* speaks for this. If this effect was due to the transfer of free histamine from the blister serum into the skin of the patient the control persons would have developed urticaria-like lesions without exposure to roentgen waves.

Unexplained remains the observation that the use of a sulfhydryl compound (cysteine) as protection from radiation could not stop the development of the urticaria-like eruption.

CONCLUSIONS

A case of urticaria-like eruption observed after X-ray treatment is reported. There is evidence that this reaction presents the characteristics of an antigen-antibody mechanism.

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